Kinematics Practice Problems 1.31.12 CP Physics

An automobile with an initial speed of 4.30 m/s accelerates uniformly at the rate of 3.00 m/s/s. Find the final speed and the displacement after 5.00 s.

$v_i = 4.30\ m/s \qquad a = 3.0\ m/s^2 \qquad t = 5.00\ s$

$v_f = ? \qquad \Delta x = ?$

$$v_f = v_i + at$$

$$= 4.30\ m/s + (3.00\ m/s^2)(5.00\ s)$$

$$= 19.3\ m/s$$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$= (4.30\ m/s)(5.00\ s) + \frac{1}{2}(3.00\ m/s^2)(5.00\ s)^2$$

$$= 59\ m$$

Kinematics Practice Problems 1.31.12 CP Physics

Billy accelerates his skateboard uniformly along a straight path from rest to 12.5 m/s in 2.5 s.
a) What is Billy's acceleration?
b) What is Billy's displacement during this time interval?
c) What is Billy's average velocity during this time interval?

$V_i = 0\ m/s \quad V_f = 12.5\ m/s \quad t = 2.5\ s$

a) $V_f = V_i + at$

$a = \frac{V_f}{t} = \frac{12.5\ m/s}{2.5\ s}$

$= 5\ m/s^2$

b) $\Delta x = V_i t + \frac{1}{2}at^2$

$= \frac{1}{2}(5\ m/s^2)(2.5\ s)^2$

$= 15.63\ m$

c) $\bar{V}_{avg} = \frac{\text{total displacement}}{\text{total time}}$

$= \frac{15.63\ m}{2.5\ s}$

$= 6.3\ m/s$

A certain car is capable of accelerating at a uniform rate of 0.85 m/s/s. What is the magnitude of the car's displacement as it accelerates uniformly from a speed of 83 km/h to one of 94 km/h?

Conversions:

$$83 \frac{\cancel{km}}{\cancel{h}} \cdot \frac{1\ \cancel{h}}{3600\ s} \cdot \frac{1000\ m}{1\ \cancel{km}} = 23.05\ m/s = V_i$$

$$94\ km/h \rightarrow 26.11\ m/s = V_f$$

$$a = 0.85\ m/s^2$$

$$V_f^2 = V_i^2 + 2a\Delta x$$

$$\Delta x = \frac{V_f^2 - V_i^2}{2a}$$

$$= \frac{(26.11\ m/s)^2 - (23.05\ m/s)^2}{2(0.85\ m/s^2)}$$

$$= 88.5\ m$$